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males led to noting their scarcity in general, and to recording in note-book when and where a male at any time was seen. The entire number seen in the past five years has been six on our place and six elsewhere. It is impossible to do more than estimate the number of females that have been seen; but when it is remembered that on several days in two summers seven have been in sight at one time, it does not appear to be an over-estimate to place their number at twelve or fifteen for each year, or six times more of them than of the males.

The simple experiments herein described are such that they may be tried by any one having a yard frequented by the Ruby-throat. If any one doubts that the female of this species will choose a saccharine diet, when it is available, let him continue the tests until convinced beyond cavil or a doubt. It is especially desirable that the experiments be made in proximity to the nesting birds in order to see if the mother will feed syrup to her nestlings. Sometimes our Catbirds and Brown Thrashers have come into the porch to the cat's plate and taken his bread and milk for their nestlings. Upon this hint for needed aid I have put bread soaked in milk on the fence railing for them, and they have taken it also. It is reasonable to believe that in like manner sweet benefactions proffered to a hard-working Humming-bird mother might be acceptable to her, and shared by her with her nestlings.

NEST LIFE OF THE CATBIRD.

Dumetella carolinensis Linn.

BY IRA N. GABRIELSON.

The data, on which this paper is based, was obtained from partial studies of three nests of this species during the summer of 1913. One of these was watched at Sioux City during the last two days of the nestling period. This nest will be referred to as nest A in the paper. The other two nests were located at Lake Okoboji, Iowa. One was observed by Mr.

Arthur F. Smith for the first two days of the nestling period at the end of which time the young died. The second Okoboji nest was under almost continuous observation from the time the first egg hatched until a terrific rain storm destroyed the last of the young ten days later. The nest studied by Smith will be referred to as nest B, and the other one, as nest C in this report.

During the Sioux City work, Mr. Howard Graham, Rush Gabrielson, and my wife helped with the study. As far as I am aware Mr. Smith carried on his study alone. It was intended that the last nest (nest C) be studied and reported jointly with Mr. Smith. But he was detained, by other duties, from giving as much time to the work as was planned. However, the author is under obligations to him for frequent relief in the blind, and also for permission to make use of the data obtained from the study of nest B. I wish to thank Prof. T. H. Macbride for placing at my disposal the facilities of the Iowa Lakeside Laboratory. I am under obligations to a number of the students of the Laboratory for assisting in the work in various ways. I wish finally to express my thanks to Prof. T. C. Stephens for his advice and assistance thruout the work and in the preparation of this report.

NEST LOCATION.

The Sioux City nest was discovered on June 15 and at that time contained three eggs. It was not visited again until June 28 when the young were about six days old. The nest was built in a partly broken down wahoo bush (*Evonymus atropurpureus* Jacq.) on the bank of a steep sided little ravine. The ravine was densely covered in most places by willows (*Salix* sp?), elderberry (*Sambucus canadensis* L.), and dogwood (*Cornus stolonifera* Michx.). The whole was overgrown with a tangle of vines of various species which made it almost impenetrable. Just across the fence was located a cherry orchard with blackberry and raspberry bushes between the tree rows. Nest B was discovered on June 24 in a small willow (*Salix longifolia* Muhl.) on the lake shore.

It was at the foot of a steep embankment and not more than twenty feet from the water's edge. No other vegetation was near except a few plants of *Stachys palustris* L. and *Polanisia graveolens* Raf. The nest was placed in a fork formed by four branches four or five feet from the ground. Nest C was found July 9 in a small, winding, densely wooded ravine leading back a short distance from the lake. It was placed in a small plum tree (*Prunus americana* Marsh.) which was growing in a dense thicket of wild raspberry bushes (*Rubus sp?*). The nest was built in a fork of the plum tree low enough to be covered entirely by the raspberry bushes.

In structure the three nests were practically alike. The lining was of fine roots and tendrils while the outside was of coarser material as twigs, string, and grass closely interwoven.

Nest A was discovered on June 15 and contained at that time three eggs. The blind was erected on the twenty-eighth and the nest was under observation June 30 and July 1 from 7:30 A. M. until dark. On the morning of the thirtieth the blind had been thrashed about by the wind until it required much repairing. While this was going on the parents were much excited, calling from the bushes and hopping nervously from place to place. Nest B was discovered June 24 and contained four eggs. The blind was erected June 31 at a distance of fifteen feet from the nest. On the second of July it was moved to within two feet of the nest and observations carried on the second and third. At the end of this time the nest was deserted. Nest C was discovered on July 9 and contained three eggs. On July 14 the blind was placed at a distance of thirty feet from the nest. From that point it was moved closer, daily, until on the twentieth it was five feet distant which was as close as it seemed necessary to bring it. This nest was under almost constant observation from 11:30 A. M. on the twenty-first to the evening of the thirtieth.

INCUBATION.

No data on incubation was secured in either of the first two studies and nothing very definite as to the length of the period in the last one. Nest C was found on July 9 and the first egg hatched on the twenty-first while the last one did not hatch until the morning of the twenty-second. This would make the incubation period at least twelve or thirteen days. The position the female assumed while incubating was characteristic. She came on the nest facing the blind and settled into it by a series of motions from side to side, working the feathers of the breast and belly well around the eggs. When she was down in the nest her tail stood almost perpendicular to the body and the head was well thrown back.

HATCHING.

Mr. Smith watched the hatching of one of the eggs in nest B while two out of three in nest C hatched during the time the nest was under observation. The first egg in nest B hatched before the study began but the second was observed to hatch on the morning of July 3. The other two eggs never opened as the nest was deserted on this same day. Mr. Smith says concerning the hatching of the second egg: "At 4:55 A. M. one more egg was pipped, evidently by the old bird, as it was chipped inward and directly around the center of the egg. This egg hatched at 5:55 A. M., the young bird forcing the shell open by rolling and plunging gently and by some use of the feet and wings. At 6:45 the female carried away half of the shell and returned at 6:48 with something in the bill which she swallowed, tho I could not determine whether it was the crushed shell or food. She left the nest at 6:53 only to return at 6:55 and take away the remaining shell."

In nest C the first egg was pipped at 9:00 A. M. on July 20 and at 7:00 P. M. all three were pipped in practically the same place. The first break in each shell came from within and was a little beyond the center of the egg toward the larger end. It was simply a slight bulging evidently pro-

duced by a blow from the beak of the young bird. A series of little cracks radiated in all directions from this place. The next thing noticed was the extension of a series of these bulges around the egg at right angles to the long axis. At 11:30 A. M. July 21 one egg had hatched and the shell had been removed. The two other eggs had four of these breaks extending about half way around the shell. From this time until three o'clock there was no change in appearance altho a number of times the female picked gently at the cracked places. On these occasions I could not see that she took anything away altho she undoubtedly broke the shell a little by these actions. At 3:00 P. M. she left the nest and was hardly out of sight when the egg she had been picking began to hatch. A dark line appeared around the shell and enlarged in a series of tiny jerks until I could see the young bird kicking and twisting within. The crack grew steadily wider until it was fully half an inch wide on the top of the egg, tho it had hardly opened at all on the side next the nest. At this point the female returned and immediately commenced picking at the shell membrane which still held the two pieces of shell together. As it came away a bit at a time, she swallowed it, repeating the process until the two pieces had fallen apart. She then seized the smaller piece (the big end of the egg and the one that contained the head of the nestling) and carried it away, leaving the nestling still in the remaining piece. In less than a minute she returned and seized the membrane still attached to the shell. As she pulled on the membrane, the nestling was lifted clear of the nest but fell back without injury. On the second attempt it pulled loose and tumbled the young one into the nest. The membrane was quickly swallowed and the remaining shell carried away. She returned immediately and picked the small bits of shell from the bottom of the nest, devoured them and commenced to brood. The actual process from the time the crack appeared until the last bits of shell were taken from the nest did not exceed ten minutes.

At 9:28 the next morning (July 22) the female partly rose from the nest displaying the separating halves of the last egg. The process was practically the same as that previously described. The parent again took the smaller piece of the shell first. She then returned and picked at the remaining piece two or three times and brooded for twelve minutes before any other move was made. At the end of that time she rose in the nest, picked the bird up in the shell and then let it down again. The shell then came away from the nestling and was removed, the small pieces being picked carefully from the nest as before.

In these three instances the hatching process seems to have been much the same. In each case it was due to the combined efforts of the parent and the young bird within the egg. In the first case the initial movement may have come from the female while in the last two it originated with the young. In all three the female assisted by pecking at the egg and by removing the broken shell from the nestling much sooner than it would have been able to free itself from the pieces.

In the Sioux City study the young were marked with string on the leg. One nestling A, being without any string, B with a brown string, and C, a white string. In nest B Smith marked the first one hatched with blue dye and the second one which died in a short time was not marked at all. In nest C two methods were tried. The nestlings were first marked with aniline dyes. In this way the first one hatched was marked blue, the second with brown, and the third was not marked at all by this method. The dyes did not give satisfaction as they had to be renewed several times a day to render the colors distinct to an observer in the blind altho they could be readily distinguished on a closer examination. After this method was tried, strings were fastened to the legs of the young and they will be designated as Blue, Brown, and White.

MARKING THE YOUNG.

BROODING.

The parents did no brooding during the time nest A was under observation. This study was made during the last two days of the nest life and the young birds were well feathered out. The weather was bright and warm, eliminating brooding as a protection from cold and rain and the nest was also well shaded thruout the day, likewise doing away with brooding as a protection from the direct rays of the sun. The study of nest B was too brief to obtain any data on brooding. Table I will show the time spent in brooding while nest C was under observation.

TABLE I.
BROODING TIME EACH DAY. NEST C.

| Date | Brooding Time | Total Time | Per cent of Brooding |
|--------------|----------------|-----------------|-------------------------|
| July 21..... | 5 hr. 53 min. | 7 hr. 35 min. | 77.58 |
| July 22..... | 11 hr. 2 min. | 15 hr. 50 min. | 69.68 |
| July 23..... | 6 hr. 51 min. | 13 hr. 40 min. | 50.11 |
| July 24..... | 8 hr. 49 min. | 15 hr. 30 min. | 56.88 |
| July 25..... | 12 hr. 4 min. | 15 hr. | 80.04 |
| July 26..... | 5 hr. | 14 hr. 35 min. | 34.28 |
| July 27..... | 7 hr. 26 min. | 15 hr. 40 min. | 47.44 |
| July 28..... | 4 hr. 50 min. | 15 hr. 15 min. | 31.69 |
| July 29..... | 4 hr. 55 min. | 15 hr. 20 min. | 32.17 |
| July 30..... | 5 hr. 54 min. | 14 hr. 45 min. | 40. |
| Total | 72 hr. 44 min. | 143 hr. 10 min. | 50.80 |

This table shows a tendency for the brooding time to decrease each day until it becomes about 30% of the observation time at which point it seems to reach the minimum. To warrant any conclusions in regard to this point it would be necessary to have practically the same weather and temperature conditions thruout the study. On two days, the twenty-second and twenty-fifth it rained steadily for several hours and the brooding time was proportionately increased, as the young were brooded most of this time. On the twenty-second it rained almost steadily from 11:00 A. M. to 5:20 P. M. and during this time the nest was uncovered only fourteen minutes. The absences, which were of short duration,

occurred at irregular intervals. The longest unbroken brooding period lasted for one hour and twenty minutes. Similarly on the twenty-fifth the nest was uncovered only nineteen minutes during the rain which lasted from 4:30 A. M. to 9:40 A. M. The longest brooding period on this occasion lasted three hours. Out of the total brooding time of 12 hours 4 minutes for this date, 5 hours 6 minutes were directly due to the rain. Leaving out of consideration these rainy days, the brooding time seemed to be divided into three more or less distinct periods. The first period from 4:30 A. M. to 7:30 A. M.; the second from 10:30 A. M. to 2:00 P. M.; and the third from 6:30 P. M. until dark. The first period was undoubtedly as a protection against the chill of the early morning which often made sitting in the blind uncomfortable work. During the second period the sun's rays fell directly into the nest and the brooding at this time was for protection against their heat. It was noticed that this period never commenced until the rays were falling into the nest and ceased as soon as the afternoon shadows were sufficient to completely shade it. Unbroken brooding periods for an hour or more were not uncommon at this time. The brooding in the evening was possibly merely preliminary to settling down on the nest for the night and was the most variable of the three. It commenced to become dark in the little ravine at about 6:30 and by 7:30 it was usually too dark to distinguish objects from the blind. On the twenty-ninth and thirtieth the noon period was very distinctly marked and consumed the greater part of the brooding time. On the twenty-ninth the early brooding totaled thirty-eight minutes, the noon period three hours and ten minutes, and the remainder was rather widely scattered thru the evening. On the thirtieth only twenty minutes were spent in brooding in the early morning, while four hours and fifty-four minutes were consumed at noon, and twenty minutes in the evening. The increase of the mid-day brooding on the thirtieth was due to the intense heat, local thermometers registering 100 degrees F. or more.

The position assumed in brooding depended on its purpose. In protecting the nestlings from rain or cold the positions were the same. The female settled down on the nest until it was completely covered and the feathers of the breast were well down over the young. It was also noted that she generally faced the wind. In brooding as a protection from the heat, she stood on the edge of the nest, with her back to the sun, wings spread, feathers of the breast ruffled and mouth open. From this study the brooding time seems to depend on three factors, viz.—temperature, rainfall, and age of the young. The temperature factor will of course be modified by the length of time the nest is shaded by the surrounding vegetation. As the young become older the brooding becomes less intense for heat or cold but remains about the same as a protection against rain.

FEEDING.

Few feeding records were obtained from nest B as the parents were very shy and finally deserted the nest. Altogether only six feedings were recorded and in but three of these was the food determined. In these three feedings 1 larva, 1 fly, and 1 bug were fed. The parents both approached the nest at various times with food but either ate it themselves or went away still carrying it in their beaks.

NEST A.

During the study of nest A which was under observation twenty-five hours and twenty minutes, on June 30 and July 1, 206 feedings were recorded. On twelve of these feedings two nestlings were fed making a total of 218 in which 241 morsels of food were given. The fact that the undergrowth was so dense prevented accurate determination of the sex of the parent feeding. For this reason no attempt is made to state the amount of feeding by each parent. It is known that both assisted in this work as on several occasions they came to the nest together with food.

An examination of table II reveals two interesting facts.

First the great variety of food given to the nestlings and second the insignificant amount of fruit used as food considering its availability. One cherry and nine blackberries were fed in the two days. This is about 4% or less than half the amount used by a pair of brown thrashers studied by the author¹ in the same vicinity in 1912 who fed 8.75% fruit.

TABLE II.

NESTLING FOOD FOR NEST A.

| FOOD | JUNE 30 | JULY 1 | TOTAL |
|----------------------------------|---------|--------|-------|
| Unidentified | 15 | 24 | 39 |
| Cricket | 23 | 12 | 35 |
| Larvæ (moth and beetle)..... | 3 | 4 | 7 |
| Cutworms | 19 | 3 | 22 |
| Maybeetles | 4 | 5 | 9 |
| Tomato worms..... | 3 | 11 | 14 |
| Grasshoppers | 9 | 5 | 14 |
| Flies | 3 | 5 | 8 |
| Beetles (except maybeetles)..... | 4 | 13 | 17 |
| Worms | 8 | 20 | 28 |
| Spiders | 2 | .. | 2 |
| Caterpillars | 4 | .. | 4 |
| Maybeetle larvæ..... | 7 | 5 | 12 |
| Butterflies | 1 | 1 | 2 |
| Katydid | 1 | 2 | 3 |
| Wireworm | 1 | .. | 1 |
| Cankerworm | 1 | 1 | 2 |
| Centipede | 2 | 1 | 3 |
| Cabbage worm..... | 1 | 1 | 2 |
| Mayfly | 1 | 3 | 4 |
| Ant | .. | 2 | 2 |
| Dragonfly | .. | 1 | 1 |
| Blackberry | 4 | 5 | 9 |
| Cherry | .. | 1 | 1 |
| Total | 116 | 125 | 241 |

The remaining 96% of the food consisted of many insect forms of which the following total 116 or 48.29%:—maybeetles and larvae, cutworms, flies, crickets, grasshoppers,

¹ Proceedings of Iowa Academy of Science for 1913.

cabbage worms, and tomato worms or some closely related species. This list includes many of the most troublesome and injurious insect pests in this vicinity during the summer and any species of bird which aids in their destruction must be beneficial to some extent. The parent birds were not noted eating the cherries or blackberries themselves altho a few were fed to the young.

NEST C.

The study of nest C which was under observation for 143 hours and 10 minutes, yielded 517 feeding records. On 51 of these visits two nestlings were fed making 568 feedings during which 596 morsels were fed. There was certainly no regurgitative feeding in this instance as two of the nestlings were under observation from the time they hatched. At 11:55 A. M., July, 21, the female approached with a measuring worm an inch long and tried several times to give it to Blue. When after numerous attempts he could not swallow it, she devoured it herself. The first food Blue was observed to get was a smaller measuring worm, and the next, a small beetle. Brown hatched at 3:07 P. M. and in just an hour received a measuring worm, followed by a fly. White was given a mayfly as his first food. Many times during the first few days of feeding the female brought grasshoppers and worms too large for the young to swallow. The method of procedure in such a case was always the same. Each nestling was tried several times and if the morsel was not then taken it was swallowed by the parent. The female did all the work in caring for the brood while the nest was under observation. This included all the daylight hours from the hatching of the first egg until the feeding activities were over, with the exception of about four hours. The male was noted several times each day, singing and foraging in the near by shrubs. Twice he approached the nest with food but did not feed the young.

From the beginning of the study Blue, who was at least five hours older than Brown and twenty-two hours older

than White, was favored in the feeding. At every approach of the parent bird with food, he would climb over the other two, and, by reaching further up than they, succeed in getting most of the food. From the first day, all three nestlings raised their opened beaks at any slight noise or jarring of the nest. With Blue getting most of the food it was only a question of time before the other two would perish. Brown was the first to succumb. He was fed at 4:35 A. M. on July 24 but from that time was totally ignored. For a time he would raise his head, open his mouth, and give the peculiar coaxing call many young birds use, but gradually he grew so weak that this was impossible. He soon lay on the bottom of the nest under the others and died before noon. The body was still in the nest at dark but had been removed by 4:30 the next morning. It may have been removed at night but it is more probable that it was done before the observer entered the blind that morning. From noon on the twenty-fifth, White was noted to be getting less and less of the food. Blue was at least twice the size of White and, on every approach of the parent, would stretch far up out of the nest with loud cries, at times completely covering him. As Blue received more of the food he became more able to trample over White and crowd him out of place. If White did succeed in getting a favorable position, Blue, on the appearance of the female, would climb over him pushing him into the bottom of the nest. On the twenty-seventh he was fed only twice: once, at 5:00 in the morning; once, at 7:11 P. M. On the morning of the twenty-eighth an unsuccessful attempt was made to force the feeding of White by removing Blue from the nest. The female immediately tried to feed him but brought insects too large to be swallowed. Blue was finally replaced in the nest and instantly commenced to appropriate all the food as before. White gradually weakened and by 9:30 was dead. The body remained in the nest until 4:25 P. M. when the parent seized it by the posterior end and flew away with it. Blue was fed up to the evening of the thirtieth and was just about ready to leave the nest at that

time. The blind was closed at 7:30 with the female on the nest. During the night a terrific rain and wind storm occurred, and when I entered the blind the next morning at 5:00 the female was on the nest but it was wet thru and Blue was dead.

The death of the nestlings thru the feeding period and the lack of assistance by the male accounts for the much lower number of feedings as compared with the brown thrasher studied in the same vicinity in 1911¹ and the yellow warbler as reported by Bigglestone.² The brown thrasher made 775 visits in 56 hours, the yellow warbler 2373 in 144 hours and 53 minutes, and the catbird only 517 in 143 hours and 10 minutes. This total does not include visits where food was brought to the nest and then devoured by the parent.

The distribution of feedings thru the various days was as follows: July twenty-first, 10 feedings; twenty-second, 35 feedings; twenty-third, 38 feedings; twenty-fourth, 57 feedings; twenty-fifth, 39 feedings; twenty-sixth, 71 feedings; twenty-seventh, 55 feedings; twenty-eighth, 64 feedings; twenty-ninth, 96 feedings; and the thirtieth, 51 feedings. It will be noted from this data, that the daily number of feedings shows a tendency to increase. This is disturbed by three factors. First, after the death of each one of the two young, Brown on the twenty-fourth and the twenty-sixth when White ceased to receive food, there is a decided drop in the number of feedings. Second, on the twenty-fifth, one of the rainy days, the number of feedings is lowered. The other rainy day, the twenty-second, came too close to the beginning of the study to make it possible to say how much the number of feedings was affected. On these rainy days the female was almost constantly brooding during the storm and consequently the time for hunting was much shortened.

¹ A Study of the Home Life of the Brown Thrasher. (*Toxostoma rufum* Linn.), by Ira N. Gabrielson. Wilson Bulletin, Vol. XXIV, June, 1912.

² A Study of the Nesting Behavior of the Yellow Warbler. (*Dendroica a. aestiva*), by Harry C. Bigglestone. Wilson Bulletin, Vol. XXV, June, 1913.

Third, the extreme heat of the thirtieth seemed to make the parent very sluggish as she did practically nothing but sit in the bushes during the greater part of the day. During the first two days of the feeding activity, the female gave a soft call as she approached the nest with food. At this call every head came up. At the end of the second day this call was practically discontinued and the nestlings had learned to detect her approach by the shaking of the bushes.

TABLE III.

| FOOD GIVEN TO NESTLINGS IN NEST C. | | | | | | | | | | | |
|------------------------------------|----|----|----|----|----|----|----|----|-----|----|--------|
| INSECTS FED | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Totals |
| Unidentified | 3 | 4 | 21 | 20 | 12 | 11 | 17 | 27 | 29 | 17 | 161 |
| Measuring worms.. | 3 | 4 | 3 | 3 | 2 | 1 | 1 | 3 | .. | 1 | 21 |
| Beetles | 1 | 1 | 2 | 16 | .. | 16 | 2 | 1 | 8 | 8 | 55 |
| Flies | 1 | 11 | 6 | 7 | 26 | 26 | 5 | 8 | 8 | 1 | 99 |
| Larvæ | 2 | 4 | 3 | 5 | 5 | 10 | 5 | 2 | 9 | 7 | 52 |
| Mayflies | .. | 5 | 5 | 3 | 5 | 2 | 6 | 1 | 13 | 2 | 42 |
| Moths | .. | 3 | 3 | .. | 2 | 6 | 7 | 3 | 4 | 7 | 35 |
| Grasshoppers | .. | 2 | 2 | 6 | .. | 6 | 6 | 7 | 10 | 1 | 40 |
| Wireworms | .. | 2 | .. | .. | .. | .. | .. | 3 | .. | .. | 5 |
| Katydids | .. | .. | 1 | 1 | .. | 2 | 1 | 1 | 3 | .. | 9 |
| Worms, var. sp.... | .. | .. | 1 | 2 | 2 | 4 | 2 | 3 | 4 | 3 | 21 |
| Spiders | .. | .. | 1 | .. | .. | 2 | .. | 2 | 7 | 5 | 17 |
| Dragonfly | .. | .. | .. | 1 | .. | 1 | 2 | 2 | .. | .. | 6 |
| Caterpillar | .. | .. | .. | .. | 1 | .. | 3 | 1 | 3 | .. | 8 |
| Mosquito | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 |
| Butterfly | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | 1 | 3 |
| Cricket | .. | .. | .. | .. | .. | .. | 2 | 3 | 5 | 1 | 11 |
| Raspberry | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 1 | 8 |
| Small frog?..... | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Gooseberry | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Total | 10 | 36 | 48 | 64 | 55 | 89 | 60 | 67 | 111 | 56 | 596 |

Under table III the unidentified includes those insects so small they could not be identified with certainty, those unknown to the person in the blind, and those so badly mangled as to be unrecognized. All of the beetles were put in one class as the number of each species was very small. Among the 55 beetles fed were recognized may-beetles, click beetles,

tiger beetles, water beetles, and snout beetles of various species. The flies were mostly fish flies tho house and stable flies were also noted. On one occasion a small frog was thot to have been fed. On the last two days of the study, wild raspberries and gooseberries were fed in small numbers. Under the title "larvae" is included all moth and beetle larvae. A few cutworms and may-beetle larvae were among them. Of all the insects used as food, flies were the most easily obtained. These and the grasshoppers were the two most conspicuous forms in the little ravine in which the nest was located. The flies were to be seen in large swarms over the bushes and the grass contained numbers of grasshoppers.

Of the 596 morsels fed, 99 or 16.61% were flies; 40 or 6.71% were grasshoppers; 142 or 23.82% were beetles, moths and their larvae; and 9 or 1.51% fruit (raspberries and gooseberries). The remaining 51.35% was made up of various insect forms in small numbers. The fruit consumed is not of any economic importance as it was all wild fruit. It is important only as further proof of the feeding of fruit to the nestlings when it is available. Deducting this 1.51%, we find that 47.14% of the nestling food in this case was composed of flies, grasshoppers, beetles, and moths, practically all of them injurious.

The most significant fact of the two studies is the great variety of insect species used as food. From these and other studies, the conclusion is drawn that the most available supply of food is largely used. Both of these little ravines teemed with insect life and as a result no one or two species stand out prominently as the source of food supply. In the study of nest C, flies were noted to be exceedingly plentiful among the bushes and many times were caught from the nest or near it but other insects were also numerous and flies do not furnish any unusual part of the food. In the case of the brown thrasher previously mentioned, it was found that grasshoppers, moths, mayflies, and cutworms totaled 1012 out of 1260 morsels fed or 80.31%. This was undoubtedly due to location. The nest was on a dry hillside with only a few scat-

tered trees and the insect forms to be found in any numbers were limited to the forms mentioned. The yellow warbler nest was located in the same kind of a ravine as the catbird nest C and the variety of insects was great, as is shown by the report. It would seem then, that the accident of location has considerable influence on the character of the food given to the nestlings. For example, location in a position representing a variety of conditions of vegetation, shade, soil, and moisture will cause a wide variety of insect species to be fed. On the other hand, a situation presenting few of these variations will limit the number of species fed and will very probably cause one or two forms to furnish a large percentage of the food. The surrounding area need not be large to furnish these conditions as all the birds yet studied seem to forage within a comparatively small area around the nest.

DISTRIBUTION OF THE FOOD TO THE NESTLINGS.

In nest A, nestling A who had left the nest at 11:16 A. M. on July 1 received 47 feedings while B and C who stayed until night received 83, and 88 feedings, respectively. Up to the time A left, B had received 41 feedings and C 60 to A's 47, or an average of 49 to each nestling. No regularity was noted in the feeding, the same one being fed three or four times in succession during some periods.

During the study of nest C, the distribution of the food to the nestlings was interrupted by the death of two out of the three nestlings while the nest was under observation. Table IV shows something of the distribution of the feedings and food during the ten days.

TABLE IV.

SHOWING THE DISTRIBUTION OF FEEDINGS IN NEST C.

| DATE | UNDETERMINED | BLUE | BROWN | WHITE | TOTAL |
|--------------|--------------|------|-------|-------|-------|
| July 21..... | .. | 6 | 6 | .. | 12* |
| July 22..... | 7 | 16 | 14 | 3 | 40* |
| July 23..... | 10 | 18 | 13 | 12 | 53* |
| July 24..... | 2 | 40 | 1 | 24 | 67* |
| July 25..... | 5 | 29 | .. | 13 | 47* |

| | | | | | |
|--------------|----|-----|----|----|-----|
| July 26..... | 1 | 54 | .. | 27 | 82* |
| July 27..... | 1 | 53 | .. | 2 | 56* |
| July 28..... | .. | 64 | .. | .. | 64 |
| July 29..... | .. | 96 | .. | .. | 96 |
| July 30..... | .. | 51 | .. | .. | 51 |
| | — | — | — | — | — |
| Totals | 26 | 427 | 34 | 81 | 568 |

* On some feedings two of the nestlings were fed.

As shown by the table, Blue received an unequal share of the food almost from the first. This share increased rapidly until the death of White, after which, he of course received all of it. This is probably not an unusual happening in the bird world altho not often witnessed. From the studies already mentioned and from others whose results have not been published, it seems that the distribution of the food is governed to a considerable extent by the strength of the nestling rather than by the exercise of any instinct or judgment of the parent feeding,—that is the nestling which is able to make the greater outcry and also make himself the most conspicuous almost invariably receives the food. This fact stood out most markedly in the study of nest C but has also been noted in other studies. On the other hand if the nestlings were nearly equal in strength the food would be more equally distributed. With both parents feeding this factor might not operate rigorously enough to cause the death of any nestling, on account of the more abundant food supply. It did not appear in this case, that the male was kept away from the nest by fear of the blind, as he was continually noted in the bushes near by and one of his favorite perches while singing was a spot in the raspberry bushes much closer to the blind than was the nest. His action must have been due to some unknown factor as the male catbird, does in some instances, at least, assist in the feeding process.

SANITATION.

In the sanitation of the nest the catbirds, were in all the studies, found to be scrupulously clean. Not only was the

excreta rarely allowed to touch the nest but the parents were continually picking parasites from it and the young. On several occasions the female in nest C probed vigorously in the bottom until the nest and the tree in which it was located vibrated violently. The shells, even to the smallest piece, were carefully removed.

From nest A, the excreta was removed 73 times while it was under observation. 67 sacs were removed from the bird last fed. The excreta was devoured 54 times and carried away 19 times. The place of depositing the sacs was not discovered, as it was impossible to follow the movements of the parents in the dense shrubbery. On one occasion while both parents were at the nest, one of them took a sac from one of the young and started to devour it. The other parent seized it and tried to pull it from the first one. After several vigorous jerks the sac broke and each one devoured the piece retained.

In nest C, as in A, the excreta was rarely allowed to touch the nest but was taken directly from the young. During this study the excreta was removed 125 times, 88 times from the nestling last fed, 20 times from some other one and in 17 instances it was not determined.

TABLE V.

SHOWING METHOD OF EXCRETA DISPOSAL. NEST C.

| DATE | DEVoured | CARRIED AWAY | TOTAL |
|--------------|----------|--------------|-------|
| July 21..... | 3 | .. | 3 |
| July 22..... | 20 | .. | 20 |
| July 23..... | 16 | .. | 16 |
| July 24..... | 20 | .. | 20 |
| July 25..... | 12 | .. | 12 |
| July 26..... | 13 | 4 | 17 |
| July 27..... | 4 | 6 | 10 |
| July 28..... | 4 | 8 | 12 |
| July 29..... | 1 | 9 | 10 |
| July 30..... | 2 | 3 | 5 |
| | — | — | — |
| Total | 95 | 30 | 125 |

Table V shows that up to the sixth day the excreta was always devoured. From this day part of it was devoured and the remainder carried away. The proportion carried away, increased to the end of the study. When carried away, it was usually taken across the ravine and out of sight among the trees. Occasionally it was taken around the blind and carried toward the head of the ravine. In either case we failed to get any data as to the final disposition.

MISCELLANEOUS BEHAVIOR AND INCIDENTS.

On approaching and leaving the nest, the behavior was fairly constant. There seemed to be, in nest A, little variation in the method of coming to the nest and both parents used the same path. They always came in sight at a certain point in the undergrowth and then came by hopping from one branch to another. Much of the time they used the same branches. In leaving a variation was noted altho in the majority of visits they returned over the same route as they approached. At other times they flew directly toward the blind from the nest and then either passed over or flew around it. In nest C the method of approach was less stereotyped. During the first five days one method was used but from that time others were used, altho the first one continued to be the favorite. The first method was to fly to the raspberry bushes at a point directly opposite the blind and come to the nest by hopping from branch to branch. The second method, and the one least used, was to fly directly to the nest, alighting on the edge next to the blind. The last method was to fly to one of the guy ropes of the blind and hop from there to the nest over the tops of the bushes. In leaving, the same three paths were followed, the first one being generally used.

The difference in the behavior of the catbirds toward the blind made an interesting study. At nest A the parents never exhibited any marked fear of the blind, even while it was being erected, but stayed in the bushes two or three yards away hopping nervously about and scolding harshly. After the blind was erected they soon became used to its

presence and used the guy ropes as perches. The blind was placed very close to nest B and may have had more effect on the parents for that reason. At any rate they became more timid and shy each day and finally deserted the nest. At nest C the female scarcely paid any attention to the blind while it was being erected or afterwards. Persons could pass in and out at any time and conversation in loud tones could be carried on in the blind without disturbing her in the least. She would hardly leave the nest long enough for us to mark the young and then generally sat a few feet away and watched proceedings without making any fuss. At one time during the study a platform was built inside the blind to level the floor. The sawing and hammering necessary to do this did not cause her to leave the nest. The male apparently paid little attention to it as he hunted right up to the edge and many times sat on the bushes within two or three feet of it while singing.

In this connection, I recently received some interesting notes from Mr. Harry C. Bigglestone regarding an attempt to study a catbird nest in 1912, and with his permission I will introduce them here. " * * * From my observations, the old birds would not feed when any one was in the blind. They would remain in the vicinity and call but would not approach the nest. I would sit in the corner out of sight of the nest and watch closely but never saw the old bird feeding. The young at times became nearly frozen and starved to death, so I would leave and sit in a path forty or fifty feet from the nest watching from there. The old birds soon started feeding but stopped again as soon as the blind was entered. This was repeated several times and always with the same results. After attempting observations for two days and the plan of staying even at intervals thruout the day had proven unsuccessful, the blind was removed." These instances show the amount of individual variation noted in the different pairs.

Nest C seemed to be quite a curiosity to the birds of the vicinity judging by the number of visitors it had. A king-

bird, brown thrasher, and yellow warbler. each came once and looked into the nest. The female paid no attention to the kingbird or warbler but was somewhat disturbed by the thrasher. Blue jays frequently came into the neighborhood and on these visits the catbird's actions were always the same. If she happened to be away from the nest, she flew to some perch from which she could watch both the nest and the jays, and remained there until they left. Her favorite perch at these times was the dead branch of an ash tree about thirty feet from the nest. If she were on the nest when they appeared, she merely settled down and remained motionless until they left. A flicker came blundering into the blind two or three times and hopped on the platform in pursuit of ants. Once he approached within a foot of my chair before he noticed me and flew out with a squawk of fright.

Of all the visitors, a house wren furnished the most amusement to those in the blind. Several times every day, he hopped to the edge of the catbird's nest and sat there inspecting it for some time, turning his head first on one side and then on the other. When the catbird appeared, he would fly around the blind. This particular wren seemed devoid of fear, as he entered the blind one or more times each day either thru the ventilator or the opening at the back of the blind. Twice he flew into the observation opening within six inches of my face to get away from the nest at the approach of the catbird. Usually she paid little attention to him, but twice flew at him and drove him away.

A chipmunk at one time climbed into a little plum tree next to the nest, during the absence of the catbird. On her return she flew at him with such violence as to knock him from the tree to the ground. On one occasion a cat, and on another a dog, passed thru the ravine near the nest. Both times she remained on the nest but was unmistakably uneasy as long as they remained in that vicinity.

The departure of only one of the nestlings was observed and that was nestling A from the Sioux City nest. His de-

parture was accomplished very simply. At about 11:15 A. M. he climbed to the edge of the nest and attempted to jump to a twig a short distance away. He fell short and tumbled to the ground without injury. At this time the parents appeared and coaxed him off into the thick underbrush in the ravine. The next morning both of the others were gone from the nest. In nests B and C the young all died before they were old enough to leave.

Marshalltown, Iowa.

BIRD NOTES FROM THE SOUTH-WEST.

BY J. L. SLOANAKER

It was with no little delight at the thought of new friends to be made in a new bird-world, that the writer prepared to leave his home in central Iowa during the intensely cold weather of middle January, 1912, and seek the warm sun and dry cactus covered sands of southern Arizona. Tucson, the metropolis of Arizona, and situated only 70 miles from the Mexican line, was our goal; and the period from January 25 to April 25 — the Arizona springtime — our stay.

Bird lovers who are wont to travel occasionally, especially those who come from the East and go into the far West or South, are indeed treated to a wealth of strange sights and new forms in the scientific world, pleasures which are not vouchsafed those who must remain in their home bird-world, but which, fortunately, can be partially enjoyed through the recorded experience of others. Stories concerning the great South-west had always intensely interested us, and we departed with a resolution not to permit other duties to rob us of the time necessary to experience as much as possible. And although there is more recorded information from Tucson than from any other part of the South-west we present our notes herewith, hoping that we may add something of interest.

By the 20th of January we were off and away, eagerly